



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER OF PATENTS AND TRADEMARKS  
Washington, D.C. 20231  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/749,590	12/28/2000	Fumio Ohtake	001752	4831

23850 7590 06/06/2002

ARMSTRONG, WESTERMAN & HATTORI, LLP  
1725 K STREET, NW.  
SUITE 1000  
WASHINGTON, DC 20006

EXAMINER

MAI, ANH D


ART UNIT	PAPER NUMBER
----------	--------------

2814

DATE MAILED: 06/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.	Applicant(s)	
09/749,590	OHTAKE ET AL. 	
Examiner	Art Unit	
Anh D. Mai	2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-17 is/are pending in the application.
- 4a) Of the above claim(s) 11-17 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 December 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of Group I, claims 1-10 in Paper No. 7 is acknowledged.

### *Specification*

2. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.
3. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

### *Drawings*

4. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the "*a native oxide film is formed between the first polycrystalline silicon film and the second polycrystalline silicon film*" must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

Art Unit: 2814

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1, 2, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over K.

Kasai et al. *W/WN<sub>x</sub>/Poly-Si Gate Technology for Future High Speed Deep Submicron CMOS LSIs*.

With respect to claims 1 and 2, Kasai teaches a semiconductor device substantially similar as claimed including:

a pair of impurity diffused regions formed in a silicon substrate, spaced from each other;  
and

a gate electrode formed above the silicon substrate between the pair of impurity diffused regions intervening a gate insulation film therebetween, the gate electrode being formed of a first polycrystalline silicon film formed on the gate insulation film, a second polycrystalline silicon film formed on the first polycrystalline silicon film and having crystal grain boundaries which are discontinuous to the first polycrystalline silicon film, and a metal nitride film (WN<sub>x</sub>) formed on the second polycrystalline silicon film, and a metal film (W) formed on the metal nitride film.  
(See Fig. 2).

Regarding the second polycrystalline silicon film, the  $\alpha$ -Si of Kasai is subjected to a high temperature anneal, thus, crystallized, hence polycrystalline silicon. Further, since the  $\alpha$ -Si is formed at a lower temperature than that of the polysilicon (first) layer, thus, the grain size is differed than that of polysilicon, therefore, the crystal grain boundary of the two layer are discontinuous. The subject matter is well known in the art.

Art Unit: 2814

With respect to claims 5 and 6, the first polycrystalline silicon film of Kasai further includes boron.

6. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsukamoto (U.S. Pub. No. 2001/0000629) in view of K. Kasai et al.

With respect to claims 1 and 2, Tsukamoto teaches a semiconductor device substantially similar as claimed including:

a pair of impurity diffused regions (16) formed in a silicon substrate (1), spaced from each other; and

a gate electrode (14) formed above the silicon substrate (1) between the pair of impurity diffused regions (16) intervening a gate insulation film (5) therebetween, the gate electrode being formed of a first polycrystalline silicon film (6) formed on the gate insulation film (5), a second polycrystalline silicon film (7) formed on the first polycrystalline silicon film (6) and having crystal grain boundaries which are discontinuous to the first polycrystalline silicon film (6), and a metal film (12) formed thereon.

Thus, Tsukamoto is shown to teach all the features of the claim with the exception of explicitly forming a barrier layer between the second polycrystalline silicon film (7) and the metal film (12).

However, K. Kasai teaches a semiconductor device including a metal nitride barrier layer ( $WN_x$ ) between the second polycrystalline silicon film and the metal film.

Art Unit: 2814

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form a metal nitride barrier layer between the second polycrystalline silicon film (7) and the metal film (12) of Tsukamoto as taught by K. Kasai to prevent reaction between the two layers.

With respect to claims 3 and 4, the semiconductor device of Tsukamoto further includes a native oxide film formed between the first polycrystalline silicon film (6) and second polycrystalline silicon film (7).

With respect to claims 5 and 6, the first polycrystalline silicon film (6) of Tsukamoto further includes boron.

With respect to claims 7 and 8, the first (6) and second (7) polycrystalline silicon film of Tsukamoto are further doped with boron. Further, the native oxide layer (20) formed between the two polycrystalline silicon films (6, 7) functions as impurities diffusion blocker (suppress fluctuations in the threshold voltage  $V_{th}$  caused by mutual diffusion of the impurities) and following an anneal step, the impurities are known to segregate toward the upper surface, therefore, the boron concentration in the first polycrystalline silicon film (6) near the interface between the first polycrystalline silicon film (6) and the second polycrystalline silicon film (7) is higher than boron concentration in the second polycrystalline silicon film (7) near an interface between the first polycrystalline silicon film (6) and the second polycrystalline silicon film (7).

With respect to claims 9 and 10, the crystal grain size of the first polycrystalline silicon film (6) of Tsukamoto is smaller than that of the second polycrystalline silicon film (7).

Art Unit: 2814

*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (703) 305-0575. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached on (703) 306-2794. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A.M  
May 23, 2002



OLIK CHAUDHURI  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800